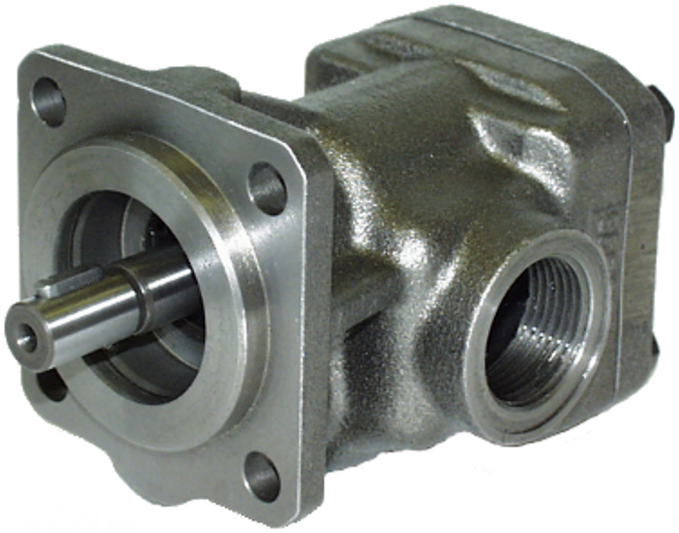
Operating instructions

BKF0004EN



Transfer Gear Pumps KF 4...80

BKF0004EN_D0024710002_04

Englisch

2010-06-09

KRACHT

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1 General points

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the transfer gear pumps **KF 4...80**, also referred to below as the device.

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

The structure of the type designation and a more detailed description of the individual series and nominal sizes can be found in the chapter "Technical data" and in the chapter "Device description".

If you have any questions about this operating manual, please contact the manufacturer.

1.2 Manufacturer´s address

Kracht GmbH

Gewerbestraße 20

DE 58791 Werdohl

phone: +49 (0) 23 92 / 935-0

fax: +49 (0) 23 92 / 935-209

email: info@kracht.eu

web: www.kracht.eu

1.3 Intended use

The device is a pump for continuous delivery of liquids. The various seal variants and materials enable use with different media.

The device has been designed for operation with fluids. Dry operation is not permitted. The medium must guarantee a minimum lubrication.

The medium must not contain any abrasive constituents.

Petrols, solvents, etc. are not permissible.

Use in explosive areas is not permissible.

It must be guaranteed that the medium is compatible with the materials used in the device (see "Overview materials" in chapter "Technical data").

The maximum permissible operating data listed in the "Technical data" chapter must always be observed.

Deviations from the above-mentioned data and operating conditions require express approval by the manufacturer and/or are specified on the type plate.

Type plates or other references on the device must not be removed nor made illegible or irrecognisable.

In cases of noncompliance, all warranty claims and manufacturer responsibility shall be void.

2 Safety

2.1 Safety instructions and symbols

The safety notices in these operating instructions are marked with caution symbols.
Non-compliance can lead to hazards for people and the device.
In addition, the safety instructions are marked with signal words. They have the meanings as explained below:
Caution: Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.
Warning: Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.
Danger: Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.

Notice: Flagging of notices to prevent property damage.

Flagging of special user tips and other especially useful or important information.

2.2 Staff qualification and training

The staff designated to install, operate and maintenance the device must be properly qualified. This can be through training or specific instruction. Staff must be familiar with the contents of this operating manual.

2.3 General safety instructions

The operational safety of the device delivered is only guaranteed when it is used for the intended purpose (see chapter "General points").
The limit values given must never be exceeded (see chapter "Technical data").
National regulations concerning accident prevention and health and safety at work must be observed, as well as internal regulations laid down by the operator, even if these are not specifically mentioned in this manual.
The operator must ensure that this operating manual is accessible to the staff responsible at all times.

2.4 Hazard statements

DANGER

Hazard caused by breakage or fluids spurting out
Positive displacement pumps must never deliver against "closed gate valves" as the uncontrollable pressures developing in this case will entail damages on the device and on upstream and/or downstream system elements.
For this reason, it is vital to use a pressure relief valve as close as possible to the pump pressure connection or another type of pressure relief device.
It must be taken into consideration that the whole delivery must be discharged via the pressure limiting device.

DANGER

Hazard caused by breakage or fluids spurting out
Only connections and pipes approved for the pressure range to be expected may be used.
The respective manufacturer's regulations must be heeded.

DANGER

Hazard caused by breakage or fluids spurting out
Damaged pipes and hoses must be replaced immediately.

DANGER

Hazard caused by hazardous fluids
When operating the device with hazardous fluids, comply with the safety datasheets and the regulations on handling these fluids.
Leaks of hazardous transport materials must be collected in such a manner that no hazards arise for people and the environment.
Always comply with the existing national and international regulations applicable at the place of installation.

DANGER

Hazard caused by rotating parts
There is a risk of snagging or getting reeled in.
The user must protect rotating parts against unintentional contact.
Existing maintenance openings on the bellhousing must be closed.
Operation without protection device is not permissible.

DANGER

Hazard caused by rotating parts and fluids spurting out
Render the connection lines pressureless and disconnect the motor from mains for all work on the device and prior to its removal.
Likewise, premature restarting of the motor during work must be prevented.

DANGER

Danger posed by voltage
The special safety regulations shall be followed for any work on electrical installations. This work may only be carried out by a qualified electrician.

DANGER

Hazard caused by falling and tipping loads
During transport, accidents can occur due to the size and weight of the device.
Compliance with applicable industrial safety requirements is mandatory.
Wear suitable protective clothing.
Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
Attach lifting tackle only to suitable points.
Attach the lifting tackle in such a manner that it cannot slip.
The unit's centre of gravity must lie between the lifting tackle mounting points on the unit.
Secure the unit so that toppling over and falling down is impossible.
Always avoid jerks, impacts and strong vibrations during transportation.
Never walk under suspended loads.
Never work under suspended loads.

WARNING

Hazard caused by shearing in case of rotating gears
Device must only be put in operation with its lines connected.

WARNING

Hazard caused by incorrect direction of rotation
An incorrect direction of rotation may result in serious damages to man and machine.
Absolutely observe the correct direction of rotation when installing the pump and connecting the motor electrically to guarantee safe operation.

CAUTION

Hazard caused by hot surfaces
The user is to take measures against unintended contact at temperatures above 60°C.

CAUTION

Hazard caused by hot surfaces
At operating temperature above 48 °C the device must be allowed to cool down first. Danger of scalding.

3 Device description

3.1 General points

KF series pumps are external gear pump types that work according to the positive displacement principle.

When rotated, two gears being engaged with each other cause volume expansion by opening the tooth gaps in the pump inlet (suction side) so that the medium can enter while a corresponding volume is being displaced in the pump outlet (pressure side) through engagement of the teeth into the filled tooth gap. Fluid transport takes place through entrainment in the tooth gaps along the wall of the wheel chamber. The so-called geometric flow rate V_g is being displaced per wheel rotation. A value that is stated in technical documents as rated volume V_{gn} to specify the pump size.

The actually delivered amount of liquid does not correspond with the theoretical value, it is being reduced through losses due to the necessary tolerances. The losses are less the lower the operating pressure and the higher the viscosity.

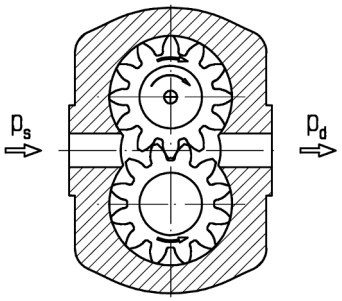
Gear pumps are self-priming within wide limits. The displacement cycle described initially takes place without exhibiting appreciable pressure build-up. Only after setting external loads, for example, through delivery head, outlet resistances, line elements, etc. the required working pressure will arise to overcome these resistances.

As usual with so-called rigid pumps, i.e. non-axial play compensated pumps, the lateral clearance between gear and front face has been set in such a way that the maximum allowable operating pressure is managed in an adequate and secure way.

The medium lubricates the pump's friction bearings. The pump's life will be reduced if the medium should contain abrasive ingredients.

The shaft sealing pocket is connected to the pump's suction side. Therefore, the max. permissible suction-side pressure is dependent on the type of seal.

Tab. 3.1: Functional principle external gear pumps

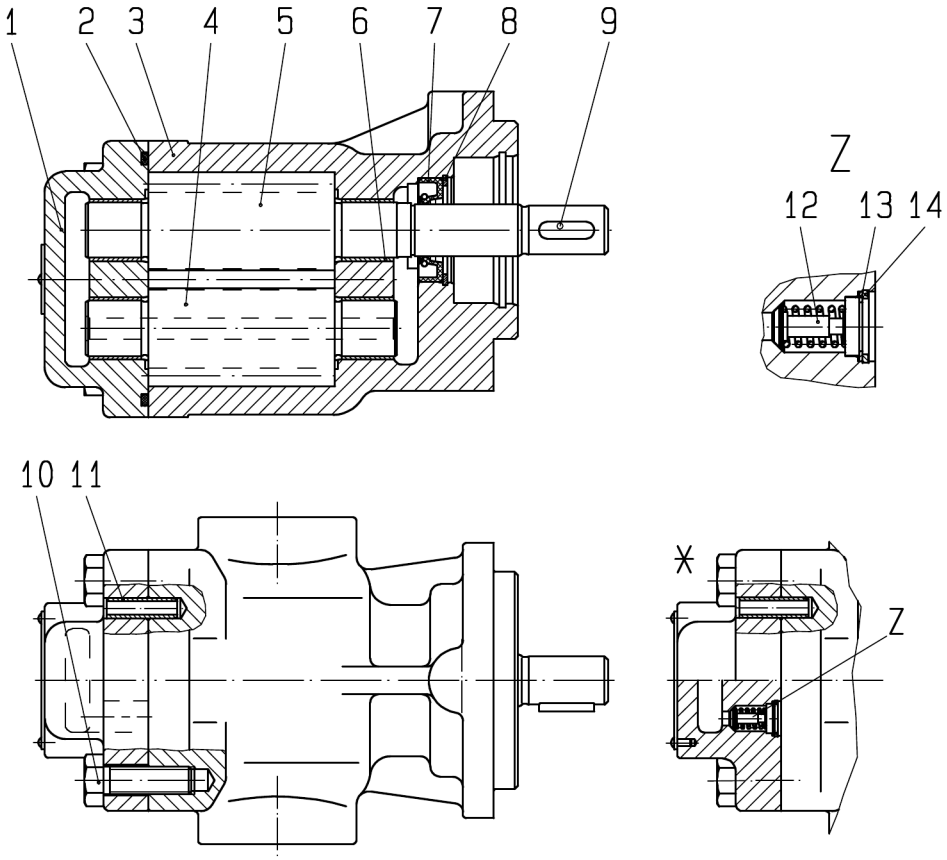


p_s = Suction side
p_d = Pressure side

3.2 Basic construction

3.2.1 KF 4...80 R/L/B

Tab. 3.2: Basic construction KF 4...80



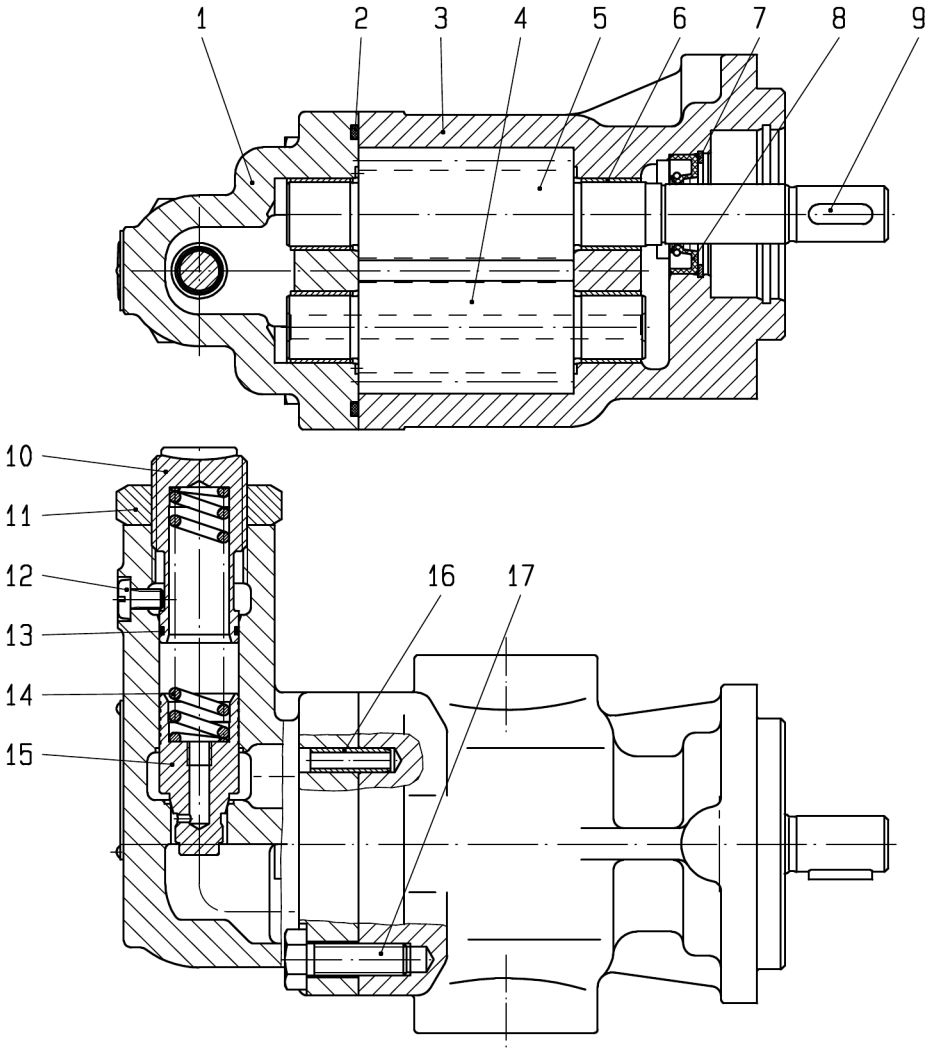
* Direction of rotation "B" (Right and left)

1. Cover
2. O-Ring
3. Housing
4. Driven shaft
5. Driving shaft
6. Plain bearing bush
7. Rotary shaft lip seal
8. Retaining ring
9. Parallel key
10. Hexagonal screw
11. Adapter sleeve
12. Valve
13. Adjusting washer
14. Retaining ring

See section "Types of seals" for further seal types.

3.2.2 KF 4...80 R/L - D

Tab. 3.3: Basic construction KF 4...80 R/L - D

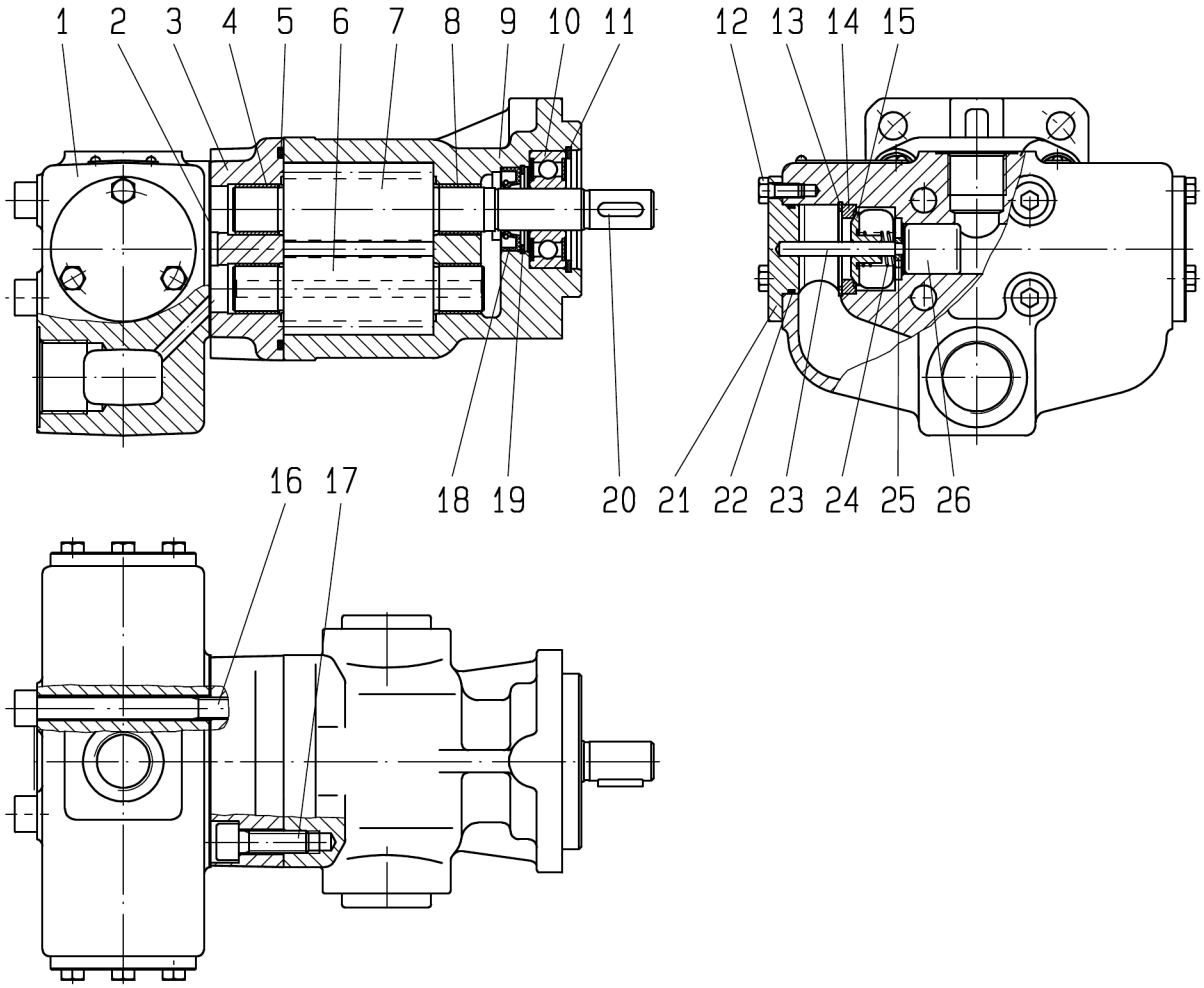


1. Valve cover
2. O-Ring
3. Housing
4. Driven shaft
5. Driving shaft
6. Plain bearing bush
7. Retaining ring
8. Rotary shaft lip seal
9. Parallel key
10. Set screw
11. Hexagonal nut
12. Retaining screw
13. O-Ring
14. Compression spring
15. Valve cone
16. Adapter sleeve
17. Hexagonal screw

See section "Types of seals" for further seal types.

3.2.3 KF 4...25 U

Tab. 3.4: Basic construction KF 4...25 U

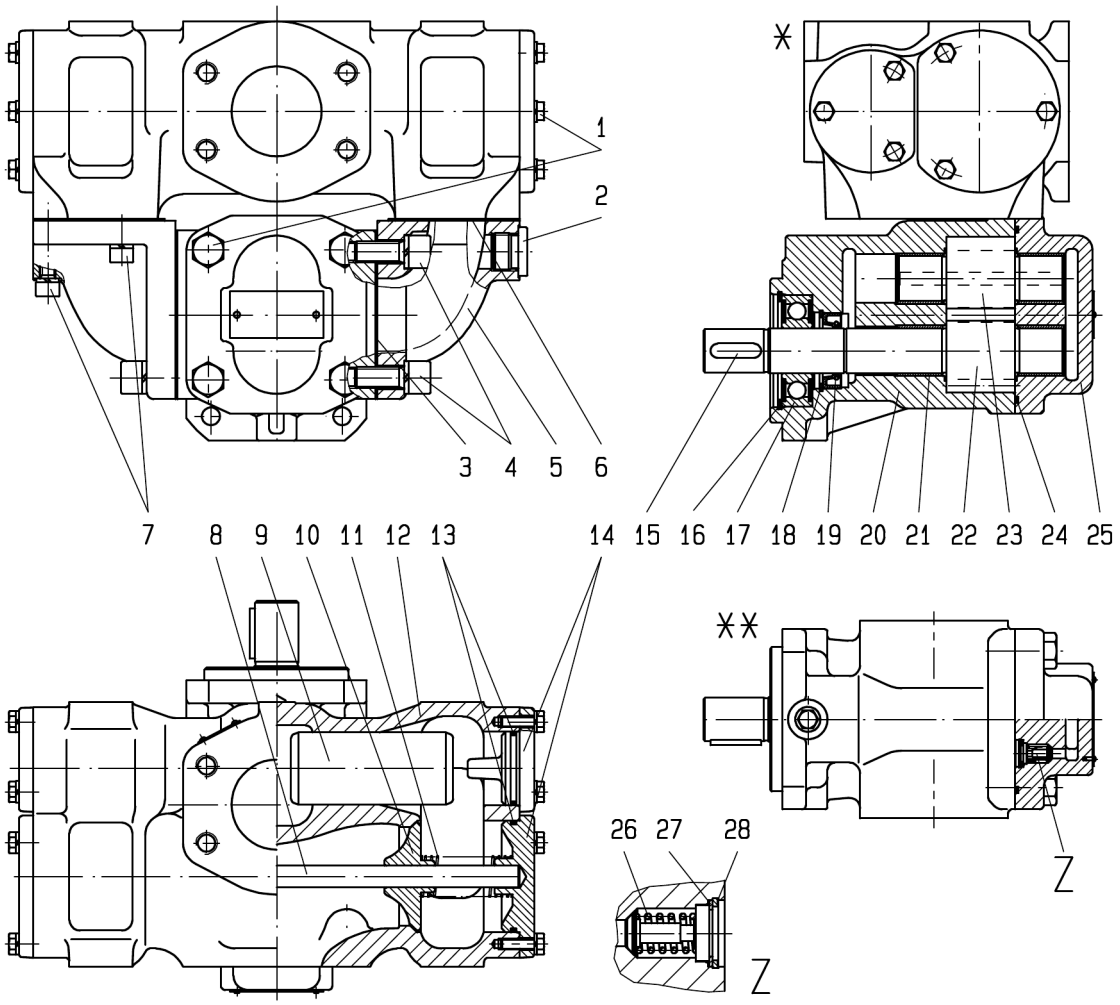


1. Valve housing
2. Gasket
3. Adapter piece
4. Plain bearing bush
5. O-Ring
6. Driven shaft
7. Driving shaft
8. Plain bearing bush
9. Housing
10. Roller bearing
11. Retaining ring
12. Hexagonal screw
13. Retaining ring
14. Valve washer
15. Valve cone
16. Socket head cap screw
17. Socket head cap screw
18. Rotary shaft lip seal
19. Retaining ring
20. Parallel key
21. Cover
22. O-Ring
23. Rod
24. Compression spring
25. Centering star
26. Piston

See section "Types of seals" for further seal types.

3.2.4 KF 32...80 U

Tab. 3.5: Basic construction KF 32...80 U



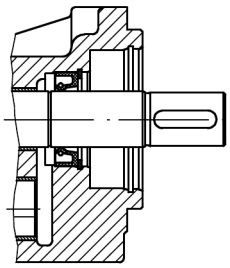
* View without connection elbow
** View without universal device

1. Hexagonal screw
2. Screw plug
3. Gasket
4. Socket head cap screw
5. Connection elbow
6. Gasket
7. Socket head cap screw
8. Rod
9. Piston
10. Valve cone
11. Compression spring
12. Valve housing
13. O-Ring
14. Cover
15. Parallel key
16. Retaining ring
17. Roller bearing
18. Retaining ring
19. Rotary shaft lip seal
20. Housing
21. Plain bearing bush
22. Driving shaft
23. Driven shaft
24. O-Ring
25. Cover
26. Valve
27. Adjusting washer
28. Retaining ring

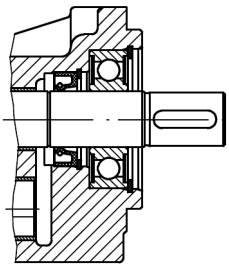
See section "Types of seals" for further seal types.

3.3 Types of seals

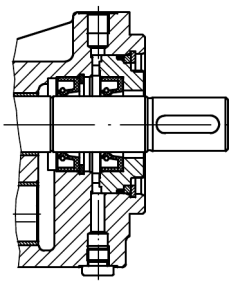
Tab. 3.6: Types of seals KF 4...80



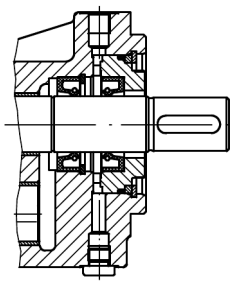
Pump with single rotary shaft lip seal
Mounting: F / W
Sealing materials:
1: NBR
2: FKM
3: PTFE
9: EPDM
23, 31: FKM (low temperature)



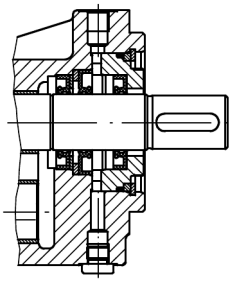
Pump with single rotary shaft lip seal and outboard bearing
Mounting: G / X
Sealing materials:
1: NBR
2: FKM
3: PTFE



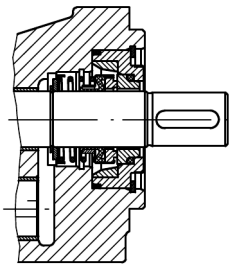
Pump with double rotary shaft lip seal with connection borehole G 1/8 for liquid seal (Quench)
Mounting: F / W
Sealing materials:
4: PTFE
7: FKM
19: NBR
32: EPDM



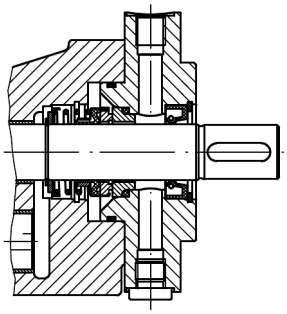
Pump with double rotary shaft lip seal for vacuum operation with connection borehole G 1/8 for liquid seal (Quench)
Special number 74
Mounting: F / W
Sealing materials:
4: PTFE
7: FKM
19: NBR
32: EPDM



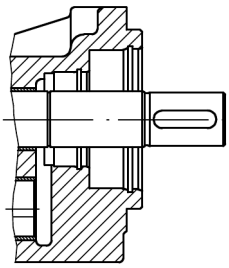
Pump with triple rotary shaft lip seal for vacuum and normal operation with connection borehole G 1/8 for liquid seal (Quench)
Mounting: F / W
(on request)



Pump with mechanical seal
Mounting: F / W
Sealing materials:
5: FKM
6: PTFE
20: EPDM



Pump with mechanical seal and connection G 1/8 (KF 4...25) or G 1/4 (KF 32...80) for liquid seal (Quench)
Special number 198
Mounting: F / W
Sealing materials:
5: FKM



Pump without shaft seal
Mounting: F / W
Sealing material:
30: FKM (O-Ring)

3.4 Type key

Tab. 3.7: Ordering example KF 4...80

KF	40	R	F	1	/...	-	D 15	-	...
1.	2.	3.	4.	5.	6.		7.		8.

Tab. 3.8: Explanation of type key KF 4...80

Explanation of type key KF 4...80				
1.	**Product name**			
2.	**Nominal size**			
	Vg	**Size 1:** 4, 5, 6, 8, 10, 12, 16, 20, 25 cm^3 **Size 2:** 32, 40, 50, 63, 80 cm^3		
3.	**Direction of rotation**			
	R	Right	**B**	Right and left
	L	Left	**U**	Universal (Direction of rotation right and left, direction of discharge consistent)
4.	**Mounting**			
	F	DIN flange without outboard bearing	**W**	Mounting angle without outboard bearing
	G	DIN flange with outboard bearing	**X**	Mounting angle with outboard bearing
5.	**Seal type**			
	1	Single rotary shaft lip seal NBR	**18**	Single rotary shaft lip seal BAUMX7 FKM
	2	Single rotary shaft lip seal FKM	**19**	Double rotary shaft lip seal NBR
	3	Single rotary shaft lip seal PTFE	**20**	Mechanical seal with EPDM secondary seal (not resistant to mineral oil)
	4	Double rotary shaft lip seal PTFE	**23**	Single rotary shaft lip seal MSS-1 FKM (low temperature)
	5	Mechanical seal with FKM secondary seal	**30**	Without shaft seal, O-Ring FKM (external leak oil discharge)
	6	Mechanical seal with PTFE secondary seal	**31**	Single rotary shaft lip seal BABSL FKM (low temperature)
	7	Double rotary shaft lip seal FKM	**32**	Double rotary shaft lip seal EPDM (not resistant to mineral oil)
	9	Single rotary shaft lip seal EPDM (not resistant to mineral oil)		
6.	**Special number for specific types**			
		See section "Important special numbers"		
7.	**Pressure relief valve** (only for direction of rotation R or L)			
	D 15	Adjustable from 0 - 15 bar	**D 25**	Adjustable from 15 - 25 bar

Explanation of type key KF 4...80		
8.	**Housing and cover material**	
		Not specified: EN-GJL-250 (GG-25)
	GJS	EN-GJS-400-15 (GGG-40)

3.5 Important special numbers

Tab. 3.9: Important special numbers KF 4...80

Special number	Description
74	Pump with double rotary shaft lip seal for vacuum operation with mounting hole for liquid seal (quench), inner rotary shaft lip seal mounted with sealing lip towards shaft end
158	SAE ¾ connections for KF 4...12, SAE 1 connections for KF 16...25
197	Noise-optimized version for aerated oils and vacuum
198	Lip-type seal with connection for liquid seal (quench)
232	SAE 2 connections for KF 50...80
304	Bearing bushings Iglidur X
317	Noise-optimized version for aerated oils and vacuum, bearing bushings Iglidur X
332	Version for low-viscous media (only in connection with material GJS), bearing bushings Iglidur X, v_{min} = 4 mm²/s at max. 10 bar
353	Noise-optimized version for aerated oils and vacuum, bearing bushings DP4 (lead-free)
355	Bearing bushings Iglidur X, SAE ¾ connections for KF 4...12, SAE 1 connections for KF 16...25
363	Version for low-viscous media (only in connection with material GJS), bearing bushings Iglidur X, v_{min} = 4 mm²/s at max. 10 bar, SAE ¾ connections for KF 4...12, SAE 1 connections for KF 16...25

Air trapped in the medium or too high negative pressure can result in delivery rate reduction for pumps in noise-optimized version.
Measures for noise optimisation are only feasible for one rotational direction and only effective for aerated oils or vacuum.

4 Technical data

4.1 General characteristics

Tab. 4.1: General characteristics KF 4...80

General characteristics KF 4...80			
Construction		External gear pump	
Materials		See section "Overview of materials"	
Fixing type		Flange DIN ISO 3019	
End of drive shaft		ISO R 775 short-cylindrical	
Pipe connection		KF 4...12	Whitworth pipe thread G 3/4
		KF 4...12/158	Flange connection SAE 3/4
		KF 16...25	Whitworth pipe thread G 1
		KF 16...25/158	Flange connection SAE 1
		KF 32...80	Flange connection SAE 1 1/2
		KF 50...80/232	Flange connection SAE 2
Installation position		KF ...R/L/B... without quench	Arbitrary*
		KF ...R/L/B... with quench	Horizontal, quenching connection on top
		KF ...U...	Horizontal, pressure connection on top
Viscosity	v_{min} v_{max}	12 mm²/s** 20000 mm²/s	
Ambient temperature	$\vartheta_{u\,min}$ $\vartheta_{u\,max}$	-20 °C 60 °C	
Speed n		See section "Overview of nominal sizes"	
Fluid temperature ϑ		See section "Overview of operating pressure and fluid temperature "	
Operating pressure p_e and p_b			
Filtering		Filter porosity ≤ 60 µm	
Permissible media		Fluids without abrasive components which are compatible with the pump materials used. The fluids must guarantee minimum lubrication. Media-specific characteristics must be taken into account. Petrols, solvents, etc. are not permissible.	

** A reduced service life must be expected for the shaft seal when vertically installed.*
*** Lower viscosities only in connection with GJS housings and reduced pressures (consult manufacturer).*

4.2 Overview of nominal sizes

Tab. 4.2: Nominal sizes KF 4...80

Nominal size*	Geom. delivery volume V_g cm^3	Speed		Permissible radial force** F_{radial} N (n=1500 rpm	Sound level L_{pA} db(A)	Weights kg		
		n_{min} 1/min	n_{max} rpm			with cover	with D-valve	with universal device
4	4,03	200	3000	700	≤ 65	2,9*** 4,2****	3,7*** 5,0****	6,9
5	5,05							
6	6,38							
8	8,05							
10	10,11							
12	12,58							
16	16,09					3,5*** 4,8****	4,3*** 5,6****	7,5
20	20,10							
25	25,10							
32	32,12	200	3000	1500	≤ 68	7,7	9,5	27,5
40	40,21							
50	50,20							
63	63,18					9,4	11,2	29,5
80	80,50							

** See type key and type designation at pump: KF ...*
*** Radial forces only at version with outboard bearing. F_{radial} on central shaft end.*
**** Valid for pump KF 4...25 with Whitworth pipe thread.*
***** Valid for pump KF 4...25 with flange connection SAE.*

4.3 Recommended speed

Tab. 4.3: Discharge pumps recommended speed

Kinematic viscosity v in mm^2/s									
< 300	300	500	1000	2000	3000	6000	10000	20000	30000
≥ 1450	1250	1000	750	600	500	400	300	200	100
Speed n_{max} in rpm									

4.4 Overview materials

Tab. 4.4: Materials KF 4...80

Seal type*	Housing/ Cover	Gear	Bearing	Shaft seal	O-Rings
1	EN-GJL-250 (GG-25) EN-GJS-400-15** (GGG-40)	Carburising steel (1.7139)	DU, P10 (Steel, sintered bronze, PTFE, Pb) Iglidur X DP4 (Steel, sintered bronze, PTFE)	NBR	NBR
2				FKM	FKM
3				PTFE	FEP
4				PTFE	FEP
5				CrMo-casting/ Carbon in synthetic resin, FKM, 1.4571, 1.4401	FKM
6				SiC-Si/SiC-Si (KF 4...25), SiC-Si/Carbon in synthetic resin (KF 32...80), FFKM, 1.4571	FEP
7				FKM	FKM
9				EPDM	EPDM
18				FKM	FKM
19				NBR	NBR
20				SiC-Si/Carbon, CrNi-steel, CrNiMo-steel	EPDM
23				FKM (low temperature)	FKM (low temperature)
30				Without shaft seal	FKM
31				FKM (low temperature)	FKM (low temperature)
32				EPDM	EPDM

** See type key and type designation at pump: KF ...*
*** For version in EN-GJS-400-15 type designation: KF ... - GJS*

4.5 Overview of operating pressure and fluid temperature

Tab. 4.5: Operating pressure and fluid temperature KF 4...80

Type of seal*	Operating pressure				Fluid temperature	
	Suction side		Pressure side			
	$p_{e\ min}$ bar**	$p_{e\ max}$ bar	p_b bar (perm. continuous pressure)	$p_{b\ max}$ bar (pressure peaks)	ϑ_{min} °C	ϑ_{max} °C
1	- 0,4***	1	25	40	- 10	90
2		2-6****				150
3		2				200
4						
5		10				150
6						200
7		2-6****				150
9		0,5				120
18						150
19		1				90
20		10				120
23		0,5			-30	150
30		25			-10	
31		1			-30	
32		0,5			-10	120
4/74	-0,9	0,2				200
7/74						150
19/74						90
32/74						120

** See type key and type designation at pump: KF ...*
*** Heed restrictions of $p_{e\ min}$ = -0,35 bar for universal design (KF .. U).*
**** Temporary during start-up condition: -0,6 bar*
***** See table "Permissible operating pressures $p_{e\ max}$ for seal types 2 and 7" for permissible pressures*

Tab. 4.6: Permissible operating pressures $p_{e\ max}$ for seal types 2 and 7

Max. speed n_{max} in rpm	Permissible pressure $p_{e\ max}$ in bar
750	6
1000	5
1500	4
2000	3
3000	2

NOTICE

The stated minimum or maximum characteristics cannot be applied for certain operating conditions.
As a result, for example, maximum operating pressure is not permissible in connection with low speed and/or viscosity.
The media-specific characteristics must be taken into account, for example, the operating temperature of aqueous dispersions and solutions is limited to 50 °C and the pump must be arranged below the liquid level and the speed limited to max. 1500 rpm.

4.6 Dimensions

Dimensions of the device can be found in the relevant technical data sheets.

5 Transport and storage

5.1 Transport damage

Inspect the device for shipping damage as soon as the delivery has been received.

If shipping damage is discovered, inform the shipping company.

If proper operation of the device is impaired by the damage, the device must be replaced or repaired. In that case, contact the manufacturer.

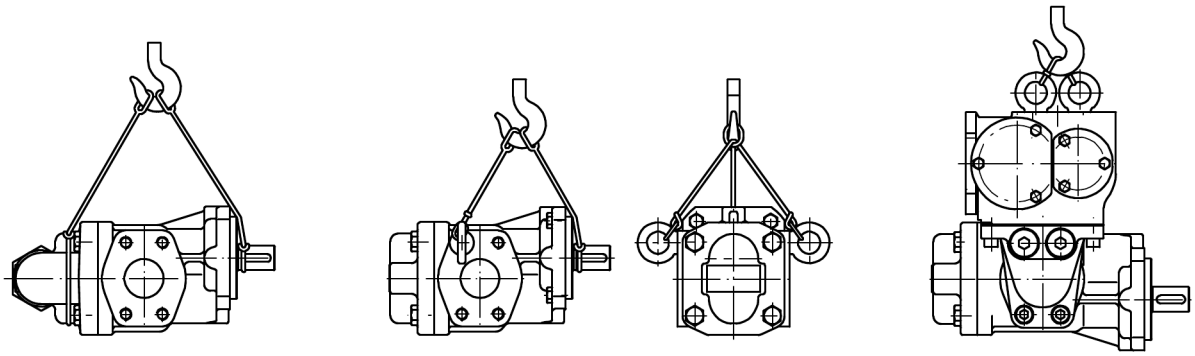
5.2 Transport

DANGER

Hazard caused by falling and tipping loads
During transport, accidents can occur due to the size and weight of the device.
Compliance with applicable industrial safety requirements is mandatory.
Wear suitable protective clothing.
Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
Attach lifting tackle only to suitable points.
Attach the lifting tackle in such a manner that it cannot slip.
The unit's centre of gravity must lie between the lifting tackle mounting points on the unit.
Secure the unit so that toppling over and falling down is impossible.
Always avoid jerks, impacts and strong vibrations during transportation.
Never walk under suspended loads.
Never work under suspended loads.

When transporting individual pumps, the eyebolts can be screwed into the connecting flange as a handling aid.

Tab. 5.1: Examples for safe transport of pumps

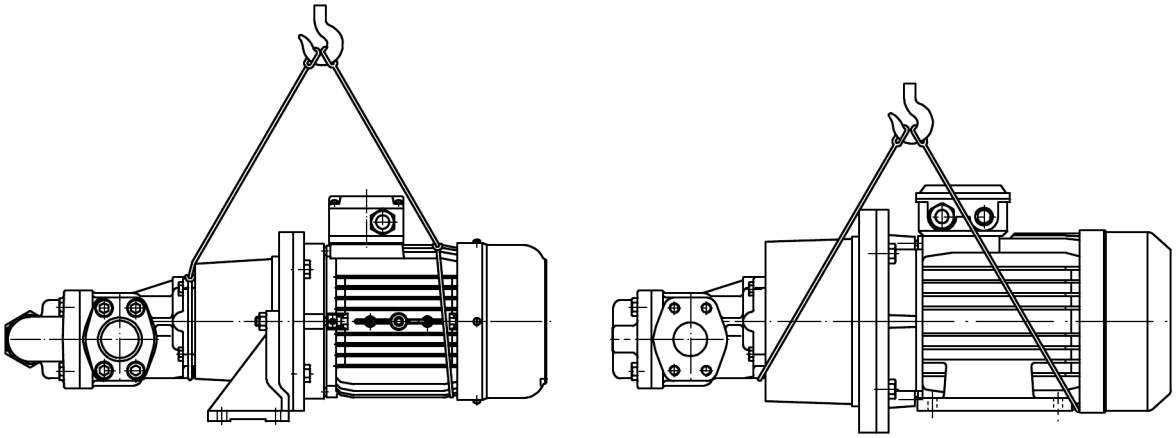


DANGER

Hazard caused by falling and tipping loads

For pump units: never use eyelets on the motor to transport the pump units. They can only support the weight of the motor.

Tab. 5.2: Examples for safe transport of pump units



5.3 Corrosion protection

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil protects the interior parts for about 6 months.

Clean bare outer metal parts have also been protected by anti-corrosive oil or protective metal paint for a period of 6 months against corrosion.

The device must not be exposed to the influence of the weather and major fluctuations in temperature during transport and storage and must be stored in a dry place.

If the device is stored over a longer period, it must be treated on the inside and outside with a suitable corrosion protection oil. In addition, it must be protected from humidity by a humidity-absorbing agent.

If high air humidity or aggressive atmosphere is to be expected during transport, suitable corrosion prevention measures must be carried out.

NOTICE

Care must be taken that the preserving agent is compatible with the materials and elastomers used. In addition, compatibility with the media used must be guaranteed.
The functionality of devices with EPDM seals is not being tested. Preservation of the interior parts does not take place. The customer needs to carry out appropriate corrosion prevention measures in cases where the device is not immediately put in operation.

6 Installation

6.1 General points

NOTICE

All work on the device may only be carried out by trained and professionally qualified staff.
During all work, care must be taken that everything remains absolutely clean.

6.2 Noise reduction

In view of optimising noise protection, it is advisable to mount a bellhousing with vibration damper between pump and motor as well as vibration dampers between motor and mounting surface. Suction and pressure piping must be able to move freely or it needs to be elastically suspended.

Installation of suction and pressure hoses diminishes the noise level of hydraulic systems. Some hose manufacturers offer special, highly flexible suction hoses for this purpose.

Installation of the pump above the liquid level diminishes the noise level of hydraulic systems. The negative pressure p_e on the pump's suction port should be approx. -0,1 ... -0,2 bar.

6.3 Definition of the direction of rotation and pumping flow

WARNING

Hazard caused by incorrect direction of rotation
An incorrect direction of rotation may result in serious damages to man and machine.
Absolutely observe the correct direction of rotation when installing the pump and connecting the motor electrically to guarantee safe operation.

6.3.1 KF 4...80

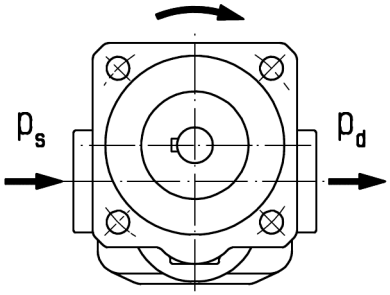
Tab. 6.1: Rotation and delivery direction KF 4...80

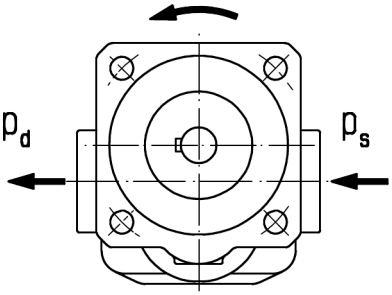
The following definition shall apply with respect to the rotation and delivery direction of external gear pumps in case of pump connections being positioned below the drive shaft:

Looking at the pump shaft end, the pumping flow is from left to right when the shaft is moving **clockwise**.

Looking at the pump shaft end, the pumping flow is from right to left when the shaft is moving **anticlockwise**.

Without pressure relief valve

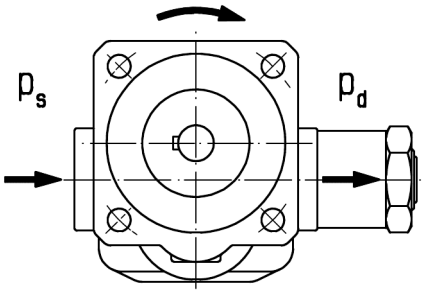


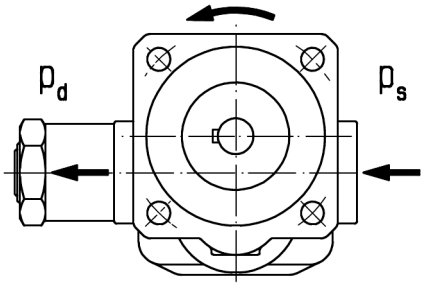


p_s = Suction side

p_d = Pressure side

With pressure relief valve





p_s = Suction side

p_d = Pressure side

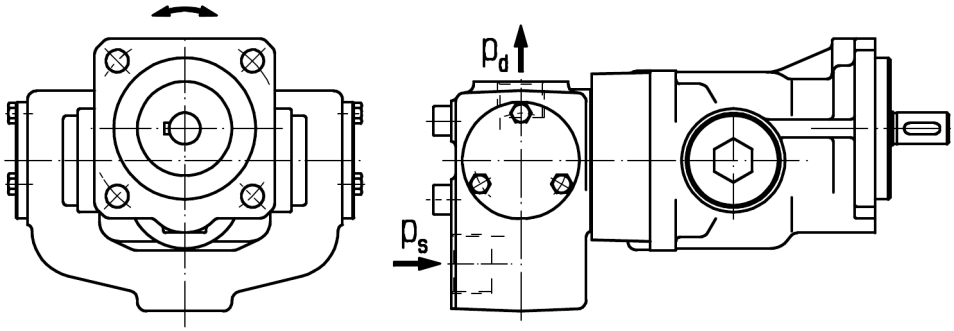
6.3.2 KF 4...25 U

Tab. 6.2: Rotating and delivery direction KF 4...25 U

With regard to the direction of rotation and pumping flow of pumps **with universal device** KF 4...25 the following definition shall apply when looking at the pump shaft end:

Direction of rotation right **and** left

Direction of discharge **consistent**



p_s = Suction side

p_d = Pressure side

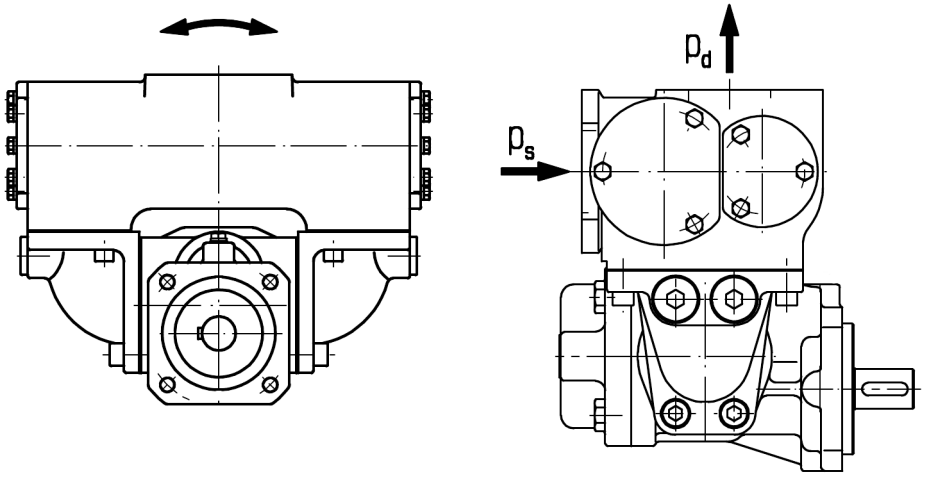
6.3.3 KF 32...80 U

Tab. 6.3: Rotating and delivery direction KF 32...80 U

With regard to the direction of rotation and pumping flow of pumps **with universal valve** KF 32...80...U2 the following definition shall apply when looking at the pump shaft end:

Direction of rotation right **and** left

Direction of discharge **consistent**



p_s = Suction side

p_d = Pressure side

6.4 Change of the direction of rotation

NOTICE

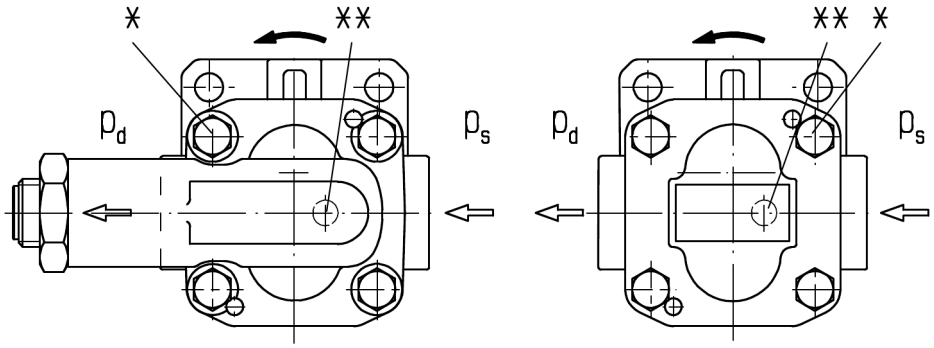
This conversion may only be carried out by trained and experienced personnel.
All warranty claims and manufacturer responsibility shall be void when improper conversion work takes place.
Cover or pressure relief valve are fixed by clamping sleeves. The bearing must not be damaged e.g. through tilting during assembly and disassembly of the cover and pressure relief valve respectively. Furthermore, the O-ring must not be removed, damaged or clamped.

Change of the direction of rotation in the case of **KF...R...** and **KF...L...** pump types, i.e. pure clockwise or anticlockwise rotating pumps, is only possible by converting the pump.

The manufacturer normally carries out the conversion work and the customer should do this only in case of an emergency.

Pumps in noise-optimized version cannot be converted.

Tab. 6.4: Change of the direction of rotation KF ...R... und KF ...L...



p_s = Suction side
p_d = Pressure side
* Fastening screws
** Leak oil hole

In case of a pump's change of the direction of rotation the cover and/or pressure relief valve must be rotated through 180°.

- Loose fastening screws.
- Remove the cover or the pressure relief valve respectively from the pump housing and put it back on rotated by 180°.
- Tighten all fastening screws applying the below mentioned tightening torques (see table "Tightening torques for fastening screws").

When checking, pay attention to the following points:

- Pumps without pressure relief valve must have their leak oil hole on the interior cover side at the pump's suction side.

- Pumps with pressure relief valve must have their pressure relief valve adjusting screw point toward the pump's pressure side.

Tab. 6.5: Tightening torques for fastening screws

Nominal size*	**4 ... 25**	**32 ... 80**
Tightening torque	25 Nm	49 Nm
** See type key and type designation at pump: KF ...*		

In the case of pumps having **seal type 6**, the mechanical seal must be replaced in addition. During this process, the spring coiling direction must be observed. Heed the assembly instructions of the respective manufacturer when replacing the mechanical seal.

6.5 Design of suction and pressure line

DANGER

Hazard caused by breakage or fluids spurting out
Only connections and pipes approved for the pressure range to be expected may be used.
The respective manufacturer's regulations must be heeded.

NOTICE

Pipelines must be fitted absolutely tension-free to the device connections.
Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the device.

Installation of suction and pressure hoses diminishes the noise level of hydraulic systems. Some hose manufacturers offer special, highly flexible suction hoses for this purpose.

6.5.1 Suction line

NOTICE

Suction line concept development must be carried out with extreme care since this will strongly influence the pump's performance.

The suction line must be piped as short as possible and in a straight line.

Avoid large suction heights.

Additional line resistances such as formed parts, fittings and closed meshed suction filters increase the pipe resistance of the suction line and must be avoided.

The negative pressure in the suction line is calculated from the sum of all suction-side resistances and the suction height considering the media-specific data.

The negative pressure can be controlled by fitting a vacuum gauge to the pump suction line connector.

Ensure proper suction when piping the suction line and the distances to the floor and to the bulkhead partitions must be sufficiently large.

The inlet port must have a sufficient distance to the lowest fluid level.

The nominal width of the suction line may actually be selected to be larger than the pump connection.

Funnel-shaped formation of the suction port at the pump suction side or obliquely cutting the suction pipe end is recommended for enlargement of the suction cross section.

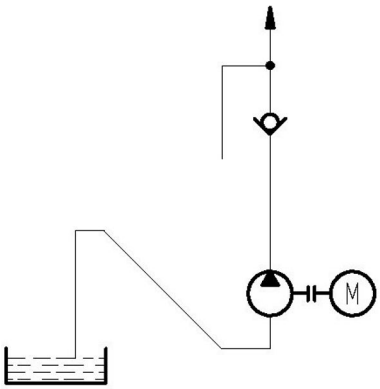
When hose lines are used on the pump suction side, care must be taken to ensure that the hoses are of sufficient stability so that they will not be constricted through the sucking action.

The media-specific data need to be observed, for example, the device must be arranged below the fluid level in case of aqueous dispersions and solutions.

The recommended flow velocity in the suction line is max. 1,5 m/s.

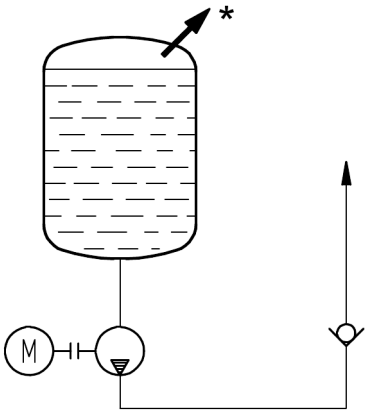
Tab. 6.6: Piping the suction line as siphon

If there is a possibility that the suction line can run dry if the pump stops, piping the suction line as siphon is an option to avoid suction problems. This way, the pump will remain permanently filled after initial commissioning.
It is appropriate to employ a foot valve or a non-return valve in cases of longer suction lines that can run dry while the pump is at rest. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



Tab. 6.7: Suction line at vacuum operation

If the pump is to intake from a tank under vacuum, the pump must be arranged approx. 0.8 m below the tank. The suction line must run in a straight line and without any resistances.
The tank may be subjected to vacuum only then when the pipework and the pump have been filled with liquid.
For this application, only pumps designed as a vacuum system may be employed.



* = Vacuum

NOTICE

The permissible pressure at the pump inlet shall not be lower than value $p_{e\ min}$ as stated in chapter "Technical data".

If the permissible value should exceed the lower limits, this will result in a drop of delivery (due to pump short filling), high noise emission and cavitation.

An exception to this is the pump's start-up condition at which a pressure of -0.6 bar (negative pressure) is tolerable for max. 30 minutes.

NOTICE

The pressure at the pump inlet must not exceed the value of $p_{e\ max}$ as stated in chapter "Technical data" as otherwise there is a risk of impermissible heating and increased wear on the shaft seal.

6.5.2 Pressure line

DANGER

Hazard caused by breakage or fluids spurting out

Positive displacement pumps must never deliver against "closed gate valves" as the uncontrollable pressures developing in this case will entail damages on the device and on upstream and/or downstream system elements.

For this reason, it is vital to use a pressure relief valve as close as possible to the pump pressure connection or another type of pressure relief device.

It must be taken into consideration that the whole delivery must be discharged via the pressure limiting device.

The nominal width of the pressure line must be selected such that the maximum permissible pressures are not exceeded.

The pressure must be checked by a manometer installed as closely as possible to the pressure connection.

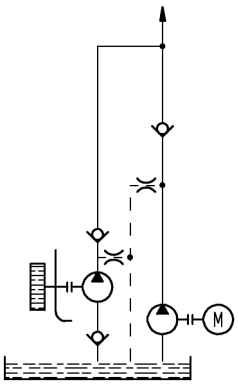
To avoid pump overload caused by an impermissibly high pressure, a pressure relief valve or a rupture disc with return to the supply tank must be installed as closely as possible to the pump's pressure connection.

Another option of pressure limiting is to mount a pressure relief valve directly to the pump.

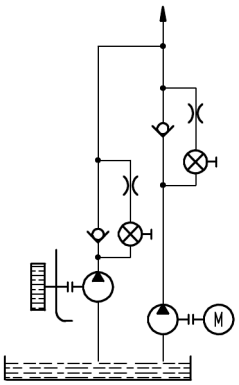
During operation of a pump that has to pump media via a non-return valve in a pressurized circuit (e.g. reserve pump in a lubricant circuit), intake problems can occur if the inlet pipe is filled with air. In this case the pressure pipe must be bled directly upstream of the non-return valve.

This can be carried out by a bleeding valve with return or a throttled bypass, for example.

Tab. 6.8: Bleeding valve and throttled bypass



Bleeding valve with return



Throttled bypass

If none of the measures described is carried out, the volume of the pressure pipe between the pump and the non-return valve must be at least 75 % of the inlet pipe volume.

6.6 Mounting the clutch

NOTICE

When dimensioning the clutch, pay attention to safe dimensioning so as to transfer the expected maximum torque reliably and permanently. Vibrations, torque peaks and temperatures need to be taken into account. The permissible values of the clutch manufacturer must not be exceeded. Heed the clutch manufacturer's installation instructions.

When mounting the clutch, keeping the "E" measure exactly is of the essence so that the clutch will remain axially movable when used. In order to avoid any frontal pressure against the elastic gear rim, measure "E" should each be considered as minimum in the case of an axial displacement.

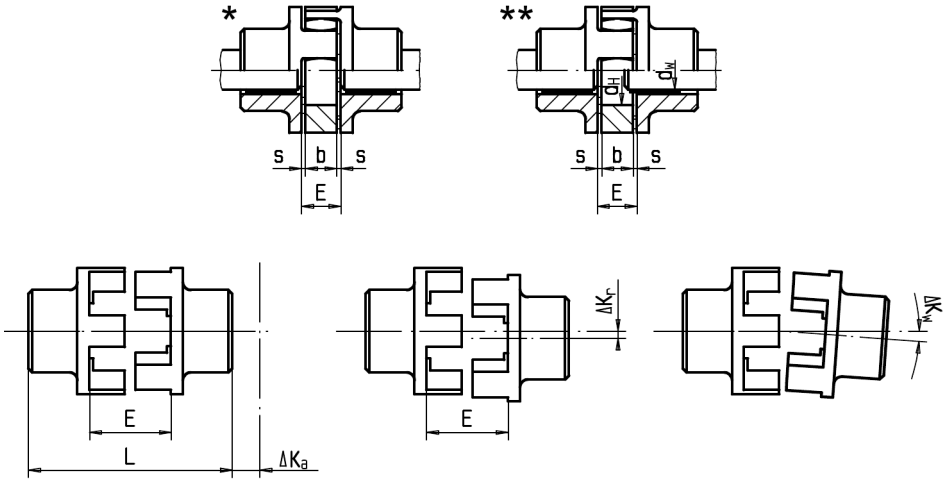
If the shaft clearance is less than clutch clearance "E", one of the shaft ends can easily extend into the gear rim. Size "d_W" corresponds to the max. shaft diameter that may extend with the parallel key into the gear rim, size "d_H". If there is the chance to offset the parallel key, i.e. only the shaft extends into the gear rim, the size of the shaft may be increased up to 2 mm below the specified "d_H" size in order not to obstruct the gear rim in its axial movability.

The permissible displacement values of the elastic clutches stated represent general guide values taking a clutch loading up the the clutch nominal torque and an operating speed n = 1500 rpm as well as an occurring ambient temperature of +30 °C into account. **Consultation with the manufacturer is necessary for deviating operating conditions.**

The displacement data may only be used individually in each case and in case of simultaneous appearance in proportion only.

Careful and exact shaft alignment increases clutch life.

Fig. 6.1: Displacements - aligning the clutch



* Clutch clearance "E"

** Shaft with parallel key extends into the gear rim (d_w)

Tab. 6.9: Types of coupling

Type of coupling*		19	24	28	38	42	48	55	65	75
		19/24	24/28	28/38	38/45	42/55	48/60	55/70	65/75	75/90
Clutch clearance**	E	16	18	20	24	26	28	30	35	40
Dimension**	s	2	2	2,5	3	3	3,5	4	4,5	5
Dimension**	d_H	18	27	30	38	46	51	60	68	80
Dimension**	d_W	12	20	22	28	36	40	48	55	65
Max. axial displacement**	ΔK_a	1,2	1,4	1,5	1,8	2,0	2,1	2,2	2,6	3,0
Max. radial displacement** n=1500 1/min	ΔK_r	0,20	0,22	0,25	0,28	0,32	0,36	0,38	0,42	0,48
Max. angular displacement n=1500 rpm	ΔK_w	1,2°	0,9°	0,9°	1,0°	1,0°	1,1°	1,1°	1,2°	1,2°

** Example: RA**19**-Z25/14-Z25/19* or *RA**19/24**-Z25/14-Z25/24*

*** Dimensions in mm*

NOTICE

The respective manufacturer's installation instructions must be observed when using other clutch types.

NOTICE

Do not knock onto the shaft during installation of the clutch halves!

The hubs should be heated for mounting the clutch and slid onto the shaft while hot.
Using a pinion gear drive, it must also be heated and slid onto the shaft end while hot.

NOTICE

Every clutch hub for cylindrical shafts must be secured on the respective shaft against axial displacement using a set screw that presses against the parallel key.

DANGER

Hazard caused by rotating parts
There is a risk of snagging or getting reeled in.
The user must protect rotating parts against unintentional contact.
Existing maintenance openings on the bellhousing must be closed.
Operation without protection device is not permissible.

6.7 Mechanical installation

NOTICE

All work on the device may only be carried out by trained and professionally qualified staff.
During all work, care must be taken that everything remains absolutely clean.
It must be guaranteed that all lines and connections are tight and no leakages can occur or air be sucked in.

- Before installation, the device must be checked for transport damage and soiling.
- Any preserving agents must be removed before installation using benzine or solvent.
- Clean the pipework of dirt, scale, sand, swarf, etc. prior to installation. Welded pipes in particularly must be pickled or flushed. Cotton waste must not be used for cleaning.
- Mount clutch and clutch halves respectively to pump and drive (see section "Mounting the clutch").

DANGER

Hazard caused by rotating parts
There is a risk of snagging or getting reeled in.
The user must protect rotating parts against unintentional contact.
Existing maintenance openings on the bellhousing must be closed.
Operation without protection device is not permissible.

- Mount pump to bellhousing, foot or housing and pay attention to careful alignment and correct fitting position (see chapter "Technical data").
- Tighten all fastening screws applying the torque as prescribed by the manufacturer of the bellhousing avoiding any twisting of the pump in the process without fail.
- Remove the protective plugs in the pump's suction and pressure connections.

DANGER

Hazard caused by hazardous fluids
When operating the device with hazardous fluids, comply with the safety datasheets and the regulations on handling these fluids.
Leaks of hazardous transport materials must be collected in such a manner that no hazards arise for people and the environment.
Always comply with the existing national and international regulations applicable at the place of installation.

WARNING

Hazard caused by shearing in case of rotating gears
Device must only be put in operation with its lines connected.

- Wet devices interiors with fluid being pumped.

DANGER

Hazard caused by breakage or fluids spurting out
Only connections and pipes approved for the pressure range to be expected may be used.
The respective manufacturer's regulations must be heeded.

NOTICE

Pipelines must be fitted absolutely tension-free to the device connections. Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the device.

- During installation, make sure that no sealant gets into the pipeline. Sealing agents such as hemp and putty are not permitted since they can lead to soiling and thus to functional problems.
- Connect suction and pressure side according to the marking on the pump or the information on the type plate (see section "Definition of the direction of rotation and pumping flow").
- Connect the pipework to the suction and pressure piping. Always heed the respective manufacturer's instructions.
- Mount a suitable tank for the liquid seal (see chapter "Operation start-up", if applicable) when operating the pump with liquid seal (quench).

DANGER

Hazard caused by breakage or fluids spurting out
Positive displacement pumps must never deliver against "closed gate valves" as the uncontrollable pressures developing in this case will entail damages on the device and on upstream and/or downstream system elements.
For this reason, it is vital to use a pressure relief valve as close as possible to the pump pressure connection or another type of pressure relief device. It must be taken into consideration that the whole delivery must be discharged via the pressure limiting device.

CAUTION

Hazard caused by hot surfaces
The user is to take measures against unintended contact at temperatures above 60°C.

NOTICE

Ensure that filling of the reservoir is carried out in absolutely clean conditions.

- Before opening, clean filler screw and shutoff on fluid transport and storage tank.
- Check media tank for contamination and clean if necessary. On no account remove the filter screen on the filler neck or the filter insert during the filling process.
- Filling the media tank with the prescribed fluid.
- Ensure sufficient filling of the media tank!

6.8 Assembly with further components and devices

NOTICE

The operator's and maintenance instructions of the respective manufacturers must be observed during assembly with further components and devices respectively. It is the only way to ensure safe and problem-free operation.

6.9 Electrical connection

DANGER

Danger posed by voltage
The special safety regulations shall be followed for any work on electrical installations. This work may only be carried out by a qualified electrician.

WARNING

Hazard caused by incorrect direction of rotation
An incorrect direction of rotation may result in serious damages to man and machine.
Absolutely observe the correct direction of rotation when installing the pump and connecting the motor electrically to guarantee safe operation.

- All data stated on the motor type plate must be checked for conformity to the required operating data.
- Adjust the overload protection to the correct value.
- Check the rotational drive direction of the pump before switching on.

7 Operation start-up

7.1 Preparation

NOTICE

All work on the device may only be carried out by trained and professionally qualified staff.
During all work, care must be taken that everything remains absolutely clean.
Before starting the system make sure that a sufficient quantity of the operating medium is available so as to avoid dry operation.
Before starting the plant, pumps and suction line must be filled with operating fluid to prevent damage to the pump and the shaft seal during dry operation. That also guarantees pump suction.
For pumps with liquid seal (quench), fill the sealing cavity with a suitable confining fluid before it is used for the first time.
It must be guaranteed that all lines and connections are tight and no leakages can occur or air be sucked in.

- Check the permissible operating data against the operating states to be expected.
- Check all fastening screws on the device.
- Fill the pump and suction line with the operating fluid.
- In the case of pumps with liquid seal (quench), fill the sealing cavity using an appropriate confining fluid (see section "Pumps with liquid seal (quench connection)").
- Checking the direction of rotation. See section "Change of the direction of rotation" in chapter "Installation" for any change in rotational direction.

7.2 Pumps with liquid seal (quenching connection)

7.2.1 Description

NOTICE

Fill the pump sealing cavity with a suitable confining fluid.
The confining fluid must be compatible with the seals and materials used as well as with the pumping medium.
The confining fluid's minimum and maximum filling level must be ensured using appropriate technical and/or organisational measures.
The liquid seal in the quenching connection must not be subjected to pressure or vacuum.

If fluids are delivered

- that cure in air,
- crystallise in contact with air humidity,
- the leakage of which must not be released into the environment,
- are under vacuum and their seal shall be gastight,

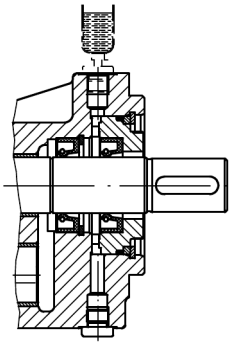
then the employment of a double seal with liquid seal is necessary.

- A tank for the liquid seal is to be connected to the quenching connection. Suitable tanks are available from the manufacturer.
- The tank for the liquid seal must be placed above the pump.
- The installation position is restricted and the quenching connection shall be directed upwards.
- Check of the fluid level in the tank must be possible at any time.

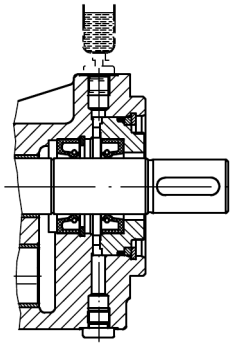
A second port on the device enables purging of the sealing cavity and draining of the seal liquid.

7.2.2 Versions

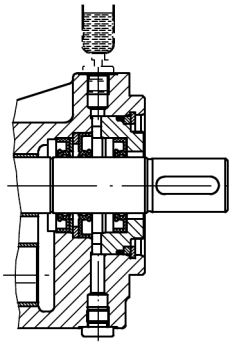
Tab. 7.1: KF 4...80 with liquid seal (Quench)



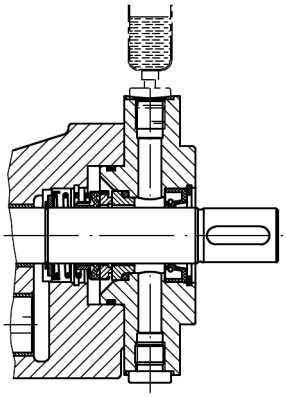
Types of seals:
4, 7, 19, 32



Types of seals:
4, 7, 19, 32
Special number 74



Triple rotary shaft lip seal
(on request)



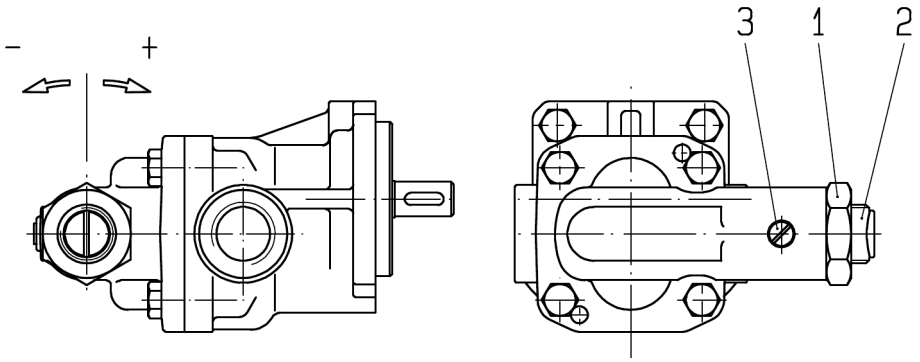
Type of seal: 5
Special number 198

7.3 Setting the pressure relief valve

Applies for pumps with built-on pressure relief valve

(Type designation: KF ... - D15 or KF ... - D25)

Fig. 7.1: Pressure setting KF 4...80 - D..



- response pressure lower

+ response pressure higher

NOTICE

The series D.. pressure relief valves are exclusively used to secure the pump. The valves may only respond **for brief periods**.
Permanent drawing off the delivery via the valve will destroy the pump through overheating.

For pressure setting on the pressure relief valve:

- loosen the hexagon nut (1)
- adjust set screw (2)
  clockwise = response pressure higher
  anticlockwise = response pressure lower
- secure the set screw (2) using hexagon nut (1) once the desired pressure has been adjusted.

DANGER

Hazard caused by breakage or fluids spurting out
Securing screw (3) on the valve must not be slackened!
At loosened securing screw, the set screw (2) can be screwed into the valve until it is completely shut.
This can result in inadmissibly high pressures in the system if there is no other pressure relief device.
Fluid can spurt out from the valve in case of fully screwed out set screw (2).

7.4 Further operation start-up

- The pumps may only start without or with low pressure load. For this purpose, open the existing shut-off elements and adjust the pressure relief valve incorporated in the pressure pipe to the lowest opening pressure.
- Start-up takes place by repeated quick on-off switching of the driving motor (jog mode) without reaching full speed until proper operation of the device is evident. This applies particularly when a cold pump is to start with already heated medium. The reason for this is to achieve slow heating of the pump and prevent the pump seizing through thermal shock.
- Proper function indicated by noise generation or on the pressure gage should be reached after max. 30 seconds.
- First of all, run the pump at zero pressure or low pressure for a couple of minutes after switching on the motor.
- Bleed the plant on the distribution pipes, preferably at the highest point.
- Pressure loading can be gradually increased up to the desired operating pressure.
- Check the temperature of the medium and that of the pump after the intended operating characteristics have been reached. Checkpoints on the pump are the bearing locations, the housing and the shaft seal. The temperatures observed on the pump surface may be approx. 10 °C above medium temperature.
- Check the fluid level of the plant once more and top up if necessary.
- Check the final operating temperature after several hours running time (see chapter "Technical data" for max. permissible temperatures).
- Check the static seals on the suction and pressure connections and the pump's joints for leakages.
- Check the threaded connections for leakages. Such leakages can be easily eliminated by simply retightening the threaded connections.
- Also check all motor and pump fastening screws after a few hours of operation.

8 Removal

8.1 General points

NOTICE

All work on the device may only be carried out by trained and professionally qualified staff.
During all work, care must be taken that everything remains absolutely clean.
Close all openings with protective caps to prevent dirt from penetrating into the system.

8.2 Disassembling the pump

DANGER

Hazard caused by rotating parts and fluids spurting out
Render the connection lines pressureless and disconnect the motor from mains for all work on the device and prior to its removal.
Likewise, premature restarting of the motor during work must be prevented.

DANGER

Hazard caused by hazardous fluids
When operating the device with hazardous fluids, comply with the safety datasheets and the regulations on handling these fluids.
Leaks of hazardous transport materials must be collected in such a manner that no hazards arise for people and the environment.
Always comply with the existing national and international regulations applicable at the place of installation.

CAUTION

Hazard caused by hot surfaces
At operating temperature above 48 °C the device must be allowed to cool down first. Danger of scalding.

- Remove the depressurised pipelines from the pump.
- Seal the pump connections and pipelines to prevent dirt penetration.
- Disassemble the pump
- Pull off clutch hub resp. the driving pinion from shaft end using an extractor.

- Immediately clean the pump or store it in such a way that curing is definitely prevented in cases where the pump was operated with curing liquids.

9 Maintenance

9.1 General points

NOTICE

Regular maintenance is essential for safe operation. Scope and intervals must be adapted to requirements. The first check-up must be carried out directly after the device has been put into operation.
The length of maintenance intervals must be defined by the operator. During visual inspections, particular attention must be paid to possible damage. In this case, the device may no longer be used.
Type and scope of maintenance as well as measured values should be documented. This is the quickest way to determine changes in operating data.

When designed to the conditions of use and fitted correctly, the devices are able to be used for long and problem-free operation. They only require a little maintenance. This is absolutely essential for problem-free operation, however. Experience shows that a high percentage of the problems and damage that occur can be traced back to dirt and lack of maintenance.

The scope and time intervals for inspections and maintenance are generally specified by the operator in a respective plan.

All removed barriers and warning signs must be put back to their original position on completing maintenance and/or repair.

Regular checking of all operating data such as pressure, temperature, current consumption, degree of filter soiling etc. contributes to early problem detection.

NOTICE

All work on the device may only be carried out by trained and professionally qualified staff.
During all work, care must be taken that everything remains absolutely clean.
Close all openings with protective caps to prevent dirt from penetrating into the system.
It must be guaranteed that all lines and connections are tight and no leakages can occur or air be sucked in.

DANGER

Hazard caused by breakage or fluids spurting out
Damaged pipes and hoses must be replaced immediately.

DANGER

Danger posed by voltage
The special safety regulations shall be followed for any work on electrical installations. This work may only be carried out by a qualified electrician.

DANGER

Hazard caused by rotating parts and fluids spurting out
Render the connection lines pressureless and disconnect the motor from mains for all work on the device and prior to its removal.
Likewise, premature restarting of the motor during work must be prevented.

DANGER

Hazard caused by breakage or fluids spurting out
Positive displacement pumps must never deliver against "closed gate valves" as the uncontrollable pressures developing in this case will entail damages on the device and on upstream and/or downstream system elements.
For this reason, it is vital to use a pressure relief valve as close as possible to the pump pressure connection or another type of pressure relief device. It must be taken into consideration that the whole delivery must be discharged via the pressure limiting device.

DANGER

Hazard caused by hazardous fluids
When operating the device with hazardous fluids, comply with the safety datasheets and the regulations on handling these fluids.
Leaks of hazardous transport materials must be collected in such a manner that no hazards arise for people and the environment.
Always comply with the existing national and international regulations applicable at the place of installation.

CAUTION

Hazard caused by hot surfaces
At operating temperature above 48 °C the device must be allowed to cool down first. Danger of scalding.

9.2 Unusual noises

Some damage is indicated by unusual noises. If there is a change in the device's operating noise, a thorough examination of the cause must always take place.

9.3 Cleaning

The pump shaft as well as the associated hardware must not run in dust accumulations.

Regular cleaning of the pump and its environment is therefore necessary.

Cleaning the pump using a steam jet cleaner is not permissible.

9.4 Static seals

The static seals on the device's separation joints and the connection lines must be periodically checked for leakproofness.

If there are any visible leaks, immediately stop plant operation.

If the leaks cannot be stopped by simply retightening the connection, replace all affected seals.

9.5 Confining fluid level

Checking the confining fluid filling level is mandatory for safe pump operation. Top up the confining fluid as required.

If there is no automatic monitoring, the filling level must be checked at least before each shift begins.

The outer but also the inner shaft seal could be leaking if the filling level should drop unusually fast within a short period of time. The confining fluid will then leak into the coupling space or it will be sucked into the pump thereby mixing with the medium.

If the filling level should rise, the inner shaft seal may probably be leaking and the confining fluid is being mixed with the pressurised medium.

Stop plant operation immediately in both cases.

9.6 Rotary shaft lip seals

Rotary shaft lip seals are particularly prone to wear for functional reasons and must accordingly be carefully checked. Too high admission pressure, wrong rotational direction or contamination lead to increased wear, increased leakage and impermissible temperature rises.

Small amounts of leakage, however, are indispensable for function. The permissible amount of leakage, though, is highly dependent on the operational conditions and cannot be quantified.

If there are excessive amounts of leakage, stop pump operation immediately. Replace the rotary shaft lip seals.

Increased wear on the rotary shaft lip seal should be taken into account in the case of vertical pump installation.

9.7 Mechanical seal

Mechanical seals are particularly prone to wear for functional reasons and must accordingly be carefully checked. Too high admission pressure, wrong rotational direction, frequent start-ups, gas or air portions in the oil or contamination lead to increased wear, increased leakage and impermissible temperature rises.

Small amounts of leakage, however, are indispensable for mechanical seal function. The permissible amount of leakage, though, is highly dependent on the operational conditions and cannot be quantified.

If there are excessive amounts of leakage, stop pump operation immediately. Replace the mechnical seal. In so doing, heed the assembly instructions of the mechanical seal manufacturer.

Increased wear on the mechanical seal should be taken into account in the case of vertical pump installation.

9.8 Clutch

Clutches must be maintained according to the specifications of the respective manufacturer.

9.9 Screw joints

All the screw joints must be checked at regular intervals to make sure they are a tight fit. Loose screw joints must be tightened and, if necessary, secured against loosening by e.g. Loctite (medium strength).

9.10 Damage

Check the pump as well as its environment regularly for damage such as dents in the clutch guard.

9.11 Surface temperature

For identifying premature wear or pump overload, it is useful to check the temperatures on the pump surface at regular intervals.

This temperatures should never be much higher (max. 10 °C) than the media temperature at the pump inlet. Checkpoints on the pump are the bearing locations, the housing and the shaft seal.

If the measured temperatures are higher than the permissible values, this is an indication of wear or bearing damages. The pump must be replaced in this case.

9.12 Bearings, gear, wheel chamber housing

Like shaft seals, bearings, gear and wheel chamber housings are wear items. Wear largely depends on the occurring loads, life cycle as well as type and proportion of solids in the medium. Wear cannot be identified from the outside.

The condition of a pump, however, can be analysed by the volumetric efficiency factor. Decrease of the efficiency factor would normally indicate wear. Therefore, a check on all operating data such as delivery, pressure, temperature, drive data, degree of filter contamination should also be carried out during maintenance work.

Further investigations into the cause are necessary in the event of major deviations (>10%) to the reference values. This helps detecting premature pump failure in time. The pump must immediately be taken out of service at a drop of delivery or pressure to 80 % of the original values. The achieved values at initial commissioning serve as reference in this case.

10 Repairs

10.1 General points

The term repairs covers:

- **Troubleshooting**, in other words establishing damage, determining and localising the reason for the damage.
- **Elimination of the damage**, in other words eliminating the primary causes and replacing or repairing faulty components.

10.2 Troubleshooting

Leaks are the most frequent problem. If these occur on the pipelines, they can be eliminated by straightforward tightening of the screw joints.

If the device itself is leaking, the respective seals have to be replaced (see spare parts list).

10.3 Elimination of damage

Repair damage onsite, predominantly by replacing the defective device. The device itself is generally repaired by the manufacturer.

If corresponding expertise and sufficient equipment is available, the consumer or OEM can also make the repairs. For support, **spare parts lists** and **sectional drawings** are available. They can be requested from the manufacturer.

NOTICE

Repair work may only be carried out by trained and professionally qualified staff. Only original spare parts may be used.

10.4 Return

If the device has to be repaired or checked over on the manufacturer's premises, it must be packed suitably for transport. In addition, a safety data sheet for the medium used must be enclosed with the device. In the case of well-known mineral oils, at least the exact type description is required.

If hardening or agglutinative media are involved, the device must be cleaned before it is returned.

Cleaning is also necessary if the device has been operated with hazardous fluids.

10.5 Detecting and eliminating problems

The following table lists the possible causes of the most frequently occuring malfunctions and notes on possible remedies.

If the problems cannot be identified, please request help from the manufacturer.

Tab. 10.1: Transfer pumps: Faults and causes

Fault	Potential causes	
Increased noise	Pump cavitation	• Negative pressure too high causing pump short filling • Suction height too high • Suction filter plugged or too small • Inner diameter of suction line too small • Suction line too long • Too many bends in the suction line • Too many local constrictions in the suction line • Suction line plugged or leaking • Too high viscosity • Temperature too low • Wrong direction of rotation
	Foaming or trapped air in medium	• Suction line leaking • Fluid level in supply tank too low • Too little oil supply • Return line to tank leaking • Wrong tank dimensioning • Shaft seal or seal on suction line leaking • Return line end above the fluid level in the supply tank • Insufficient venting • Too strong foaming in the gear
	Mechanical vibrations	• Incorrectly aligned or loose clutch • Magnetic coupling defective • Faulty or insufficient line fastening • Wobbling pressure relief valve • No noise-optimized design (missing dampers) • Unfavourable place of pump installation • Pump worn out, tooth flanks worn out • Disturbances in pump operation

Fault	Potential causes	
Pump does not suck		• Too high negative pressure • Fluid level in supply tank too low • Magnetic coupling torn off • Wrong direction of rotation • Throttled shut-off element in the suction line • Suction line too long • Suction line leaking • Suction resistance too high • Foreign objects in suction line • Volume of pressure pipe between pump and non-return valve too little, pump cannot compress the air contained in the suction line • Non-return valve not bled • Too high start-up pressure if suction line is filled with air • Speed too low
Insufficient delivery		• Too high negative pressure • Throttled shut-off element in the suction line • Fluid level in supply tank too low • Suction filter plugged or too small • Too high viscosity • Too low viscosity • Too high speed • Too high pressure • Pressure relief valve set too low • Pump sucks air • Pump worn out • Too high proportion of air in the oil • Universal valve defective
Insufficient pressure	Delivery too low Work drags in pressure pipe too low	• Too low viscosity • Pressure relief valve set too low or does not shut • Too low speed • Driving power too low • Pump worn out
Excessive power consumption		• Too high pressure • Too high viscosity • Driving power too low • Motor winding defective

Fault	Potential causes	
Excessive operating temperature		• Pressure relief valve set too high • Speed too high • Cooling and heat dissipation insufficient • Supply of fluid too low • Fluid is being delivered into the supply tank via pressure relief valve under load
Impermissible pump heating		• Delivery-side valve cone not completely shut • Directly mounted pressure relief valve set too low (does not apply for the "universal valve" and "T-valve" versions) • Too high pressure • Too low viscosity • Gland lid overtightened • Separating can insufficiently bled • Admission pressure impermissibly high • Pump worn out
Leakages on shaft seal		• Admission pressure impermissibly high • Wrong direction of rotation • Too high radial shaft loading • Temperature at sealing point too high • Wrong seal material • Missing confining fluid • Separating can defective • Sealing wear due to poorly lubricating medium • Sealing wear through abrasive components in medium • Sealing wear through curing medium • Gland lid not sufficiently tightened
Clutch wear		• Incorrectly aligned or loose clutch • Axial clutch clearance insufficient • Clutch overloaded • Temperature too high
Magnetic coupling torn off		• Magnetic coupling under-dimensioned • Pressure too high • Driving motor oversized • Too high starting torque • Too high operating temperature • Pump is blocking due to foreign objects

Fault	Potential causes	
Short operational lives	Wear on bearing, gear and housing parts	• Wear through abrasive components • Wear due to poorly lubricating medium • Too low viscosity • Check corrosion, material compatibility • Too high operating pressure for the media properties